Coast 2050 Region 3

BOSTON CANAL /VERMILION BAY SHORELINE PROTECTION (T/V-09)
T/V-09-MSPR-0997-4
PROGRESS REPORT NO. 4
for the period
December 4, 1994 to September 1, 1997

Project Status

No additional data have been collected since the previous progress report.

Project Description

The Boston Canal/Vermilion Bay Shoreline Stabilization (T/V-09) project was designed to evaluate the ability of a rock breakwater and vegetation plantings to abate wind-driven wave erosion along Vermilion Bay and at the mouth of Boston Canal, located in Vermilion Parish (figure 1). In December 1994, rock breakwaters were constructed parallel to the banks of Boston Canal, extending into Vermilion Bay and then turning 90 degrees to follow the bay shoreline. Behind the breakwaters, sediment fences were installed to capture sediment during overwash events. In October 1995, approximately 34,000 trade gallon-size plants of *Spartina alterniflora* (smooth cordgrass) were planted along 14.3 mi (23 km) of bay shoreline from Mud Point on the western end, to Oaks Canal on the eastern end (figure 1).

The project objectives are to maintain the integrity of approximately 466 ac (186 ha) of wetlands between Mud Point and Oaks Canal, to stabilize 14.3 mi (23 km) of the Vermilion Bay shoreline, and to prevent further regression of the banks at the mouth of Boston Canal. The specific goals are (1) to decrease the rate of shoreline erosion at the confluence of Boston Canal and Vermilion Bay by armoring the mouth of the canal with rock breakwaters, (2) to increase the deposition of sediment adjacent to sediment fences behind the breakwater, and (3) establish *S. alterniflora* along 14.3 mi (23 km) of shoreline to decrease the rate of erosion and maintain the integrity of approximately 466 ac (186 ha) of interior marsh on the northern edge of Vermilion Bay.

Methods

Sediment deposition behind the breakwater was surveyed along 5 east-west transects and 6 north-south transects in October 1994 (pre-construction) and in May 1995 (post-construction) to document the accumulation or erosion of sediment in the vicinity of the sediment-trapping fences.

To document planting success, the planting area was divided into four land types based on topography (figure 1). Land type 1 is a straight mineral shoreline with a gradual slope. The shoreline of land type 2 is deeply scalloped, consisting of cutbanks and gently sloped inlets with high organic content. Land type 3 is a gently scalloped shoreline with a mineral soil. Land type 4 is gently scalloped with a mineral soil, but is recognized as a different land type due to its north-south orientation and the protection it receives from Tigre Lagoon. A 3% sample of the vegetation plantings in each land type, consisting of 64 randomly selected plots of 16 plants each, was

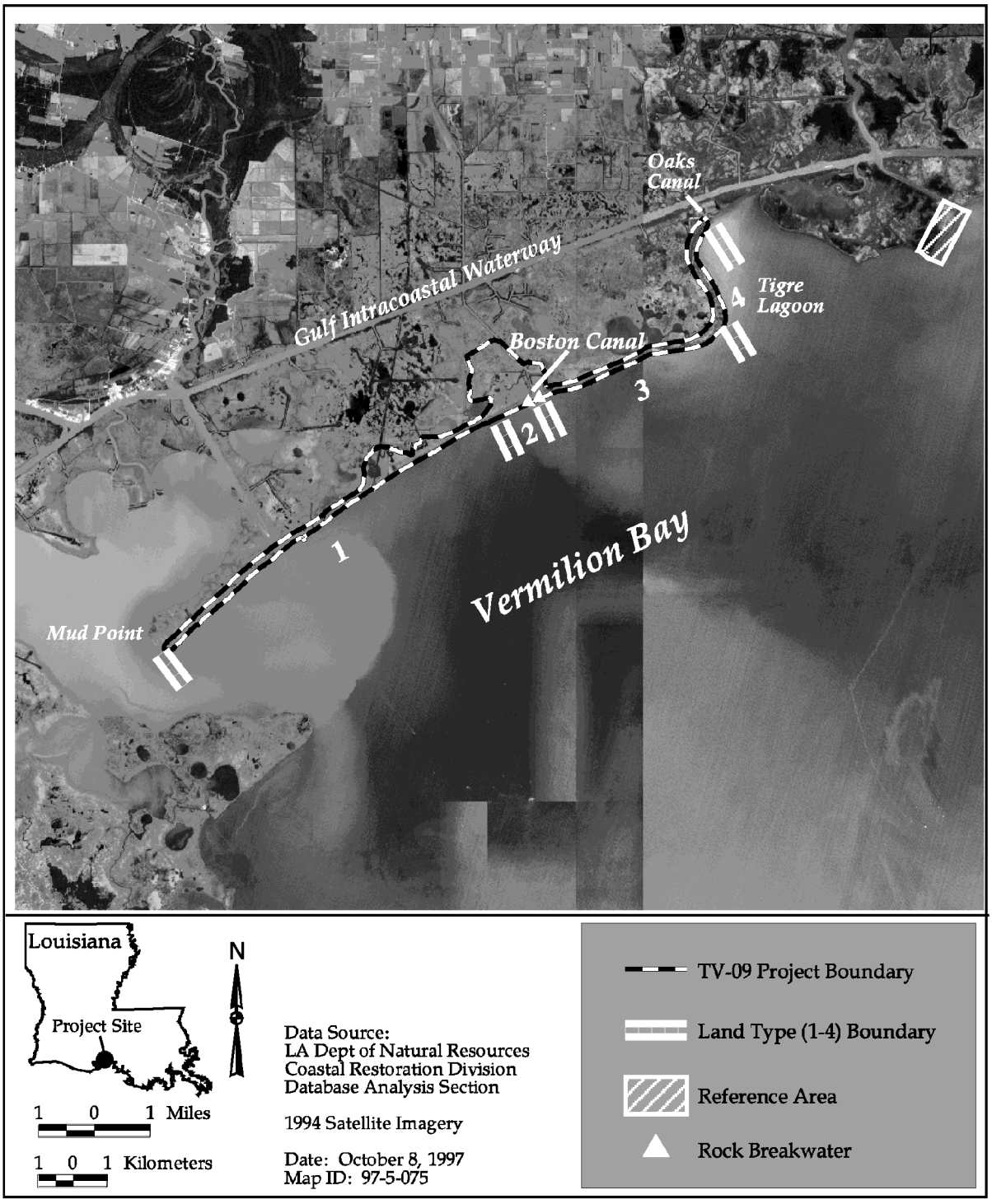

Figure 1. Boston Canal/Vermilion Bay Shoreline Protection (TV-09) project area, reference area, and land type boundaries.

monitored for percent survival, species composition, and percent cover on December 6, 1995, and June 6, 1996.

Planting survival was evaluated in terms of four variables (Harper 1977), which are defined and calculated as follows:

$$\text{survival frequency} = \text{number of live plants inside plot at timepoint } x$$

$$\text{survivorship } (l_x) = \text{probability (at planting time) of surviving until age } x = \frac{\text{no. live plants inside plot at timepoint}}{\text{original no. plants inside plot}}$$

$$\text{mortality } (d_x) = \text{probability (at planting time) of dying during age interval } x, x+1 = l_x - l_{x+1}$$

$$\text{mortality rate } (q_x) = \text{probability of a planting at age } x \text{ dying before the age of } x+1 = \frac{l_x - l_{x+1}}{l_x} = \frac{d_x}{l_x}$$

For the project and reference areas, flight plans were generated and high resolution color infrared aerial photography was flown on December 26, 1994 at a scale of 1:12,000. Photography was received and then quality checked for flight accuracy and color consistency. The duplicate roll of photography was cut, indexed, and filed in binders for future reference. All photography has been scanned, digitally converted, and spectrally enhanced; photomosaicking is in progress for base map production. Global Positioning System (GPS) field data have been collected to georeference the base map. A post-construction flight was conducted in October 1997.

Continuous differential Global Positioning System (GPS) coordinates will be established at the mean high water line along the existing shoreline adjacent to vegetative plantings in the project area, and at a reference site located east of Oaks Canal. GPS data will be obtained during preconstruction and in 1998 and 2011 (post-construction) to document changes in shoreline position over time.

Results/Discussion

Rock breakwater: In October 1994, preconstruction elevation profiles were surveyed across the rock breakwaters (figure 2). Comparison with data from a subsequent survey conducted in May 1995 revealed that up to 4.5 ft (1.4 m) of sediment has been deposited between the breakwaters and the existing shoreline (figures 3, 4 and 5). The exposed mudflats are being colonized by *Echinochloa walteri* (Walter's millet) and *Bacopa monnieri* (coast water-hyssop*)*. Observations to date suggest that the rock breakwaters have been highly effective in promoting sediment deposition and retaining this sediment at the mouth of Boston Canal.

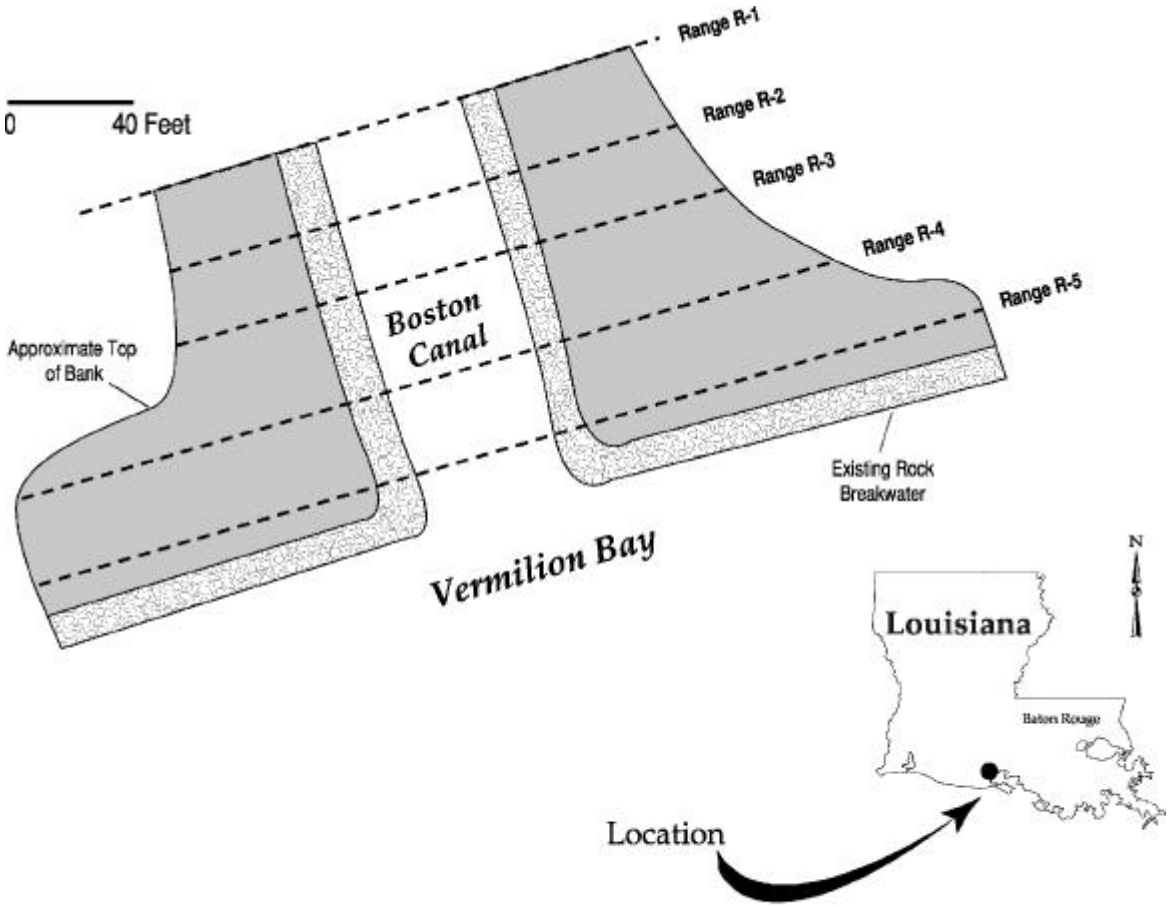

Figure 2. Boston Canal/Vermilion Bay Shoreline Protection (T/V-09) cross section of the mouth of Boston Canal labeling elevational transects.

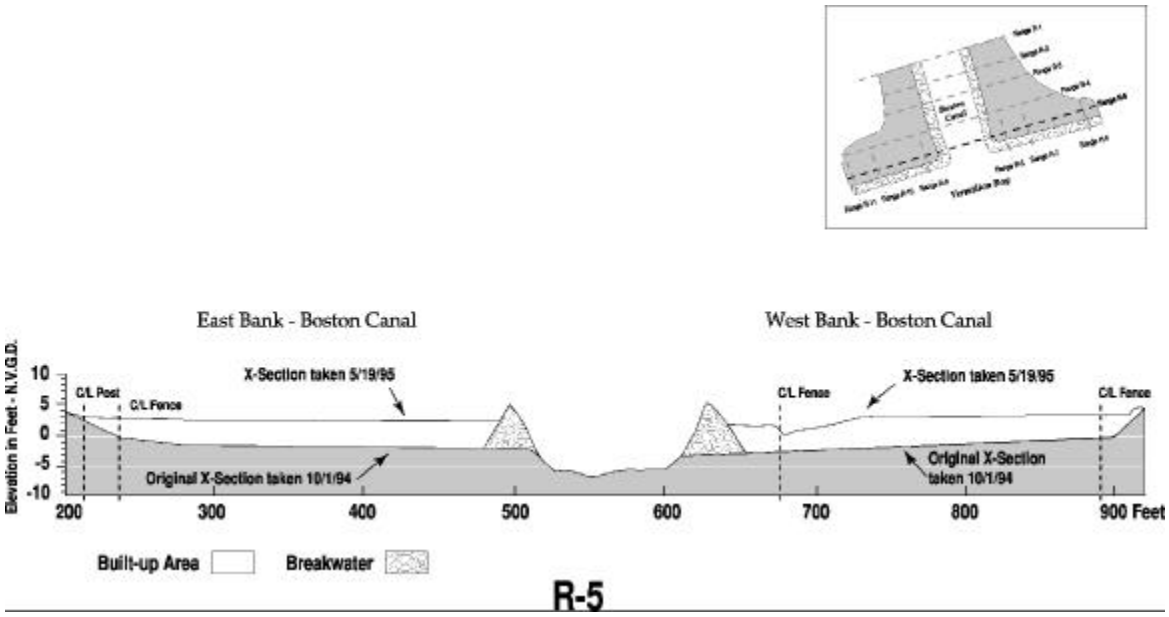

Figure 3. Boston Canal/Vermilion Bay Shoreline Protection (T/V-09) elevational profile of east-west transect R-5 showing accretion.

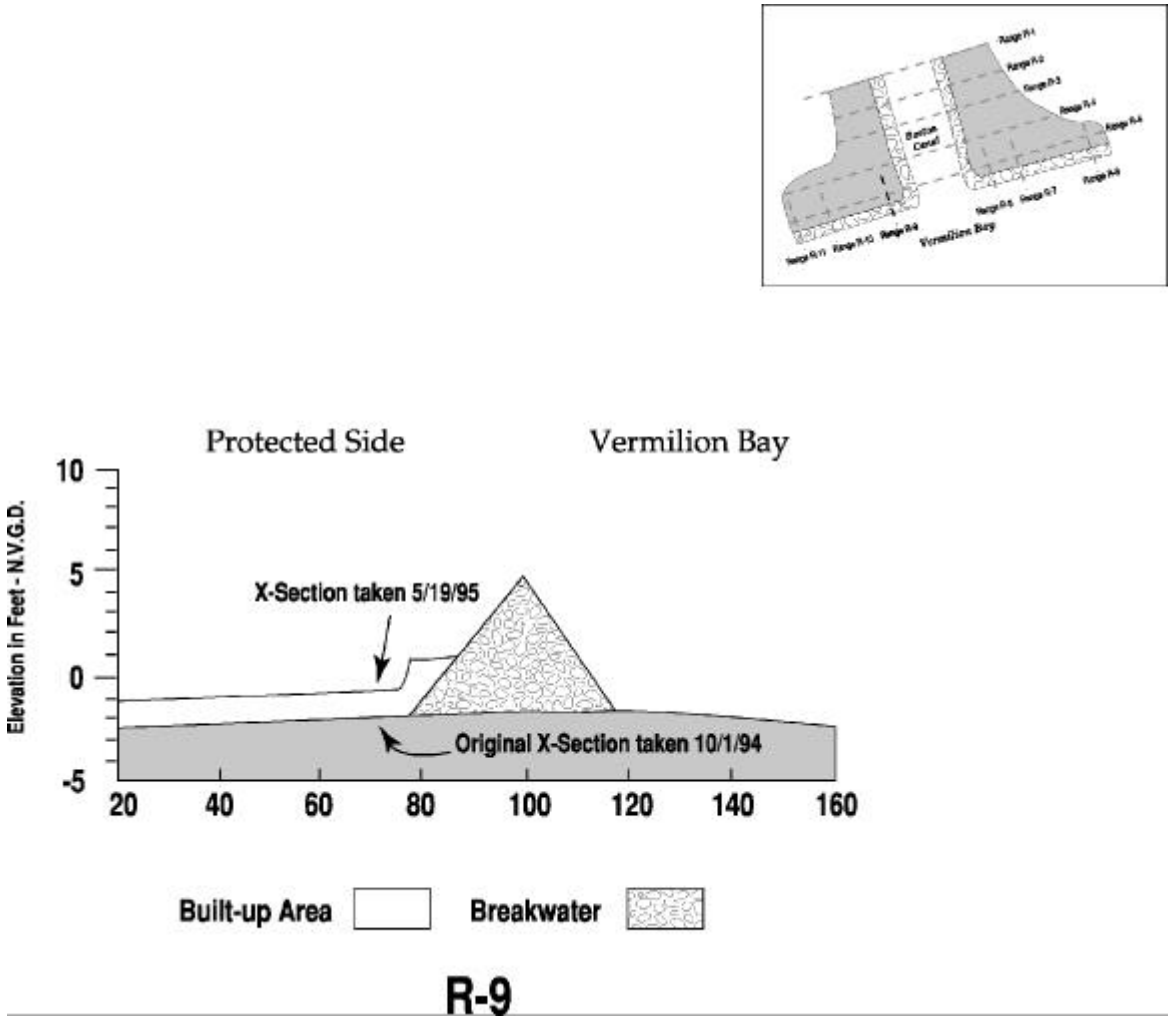

Figure 4. Boston Canal/Vermilion Bay Shoreline Protection (T/V-09) elevational profile of north-south transect R-9 showing accretion.

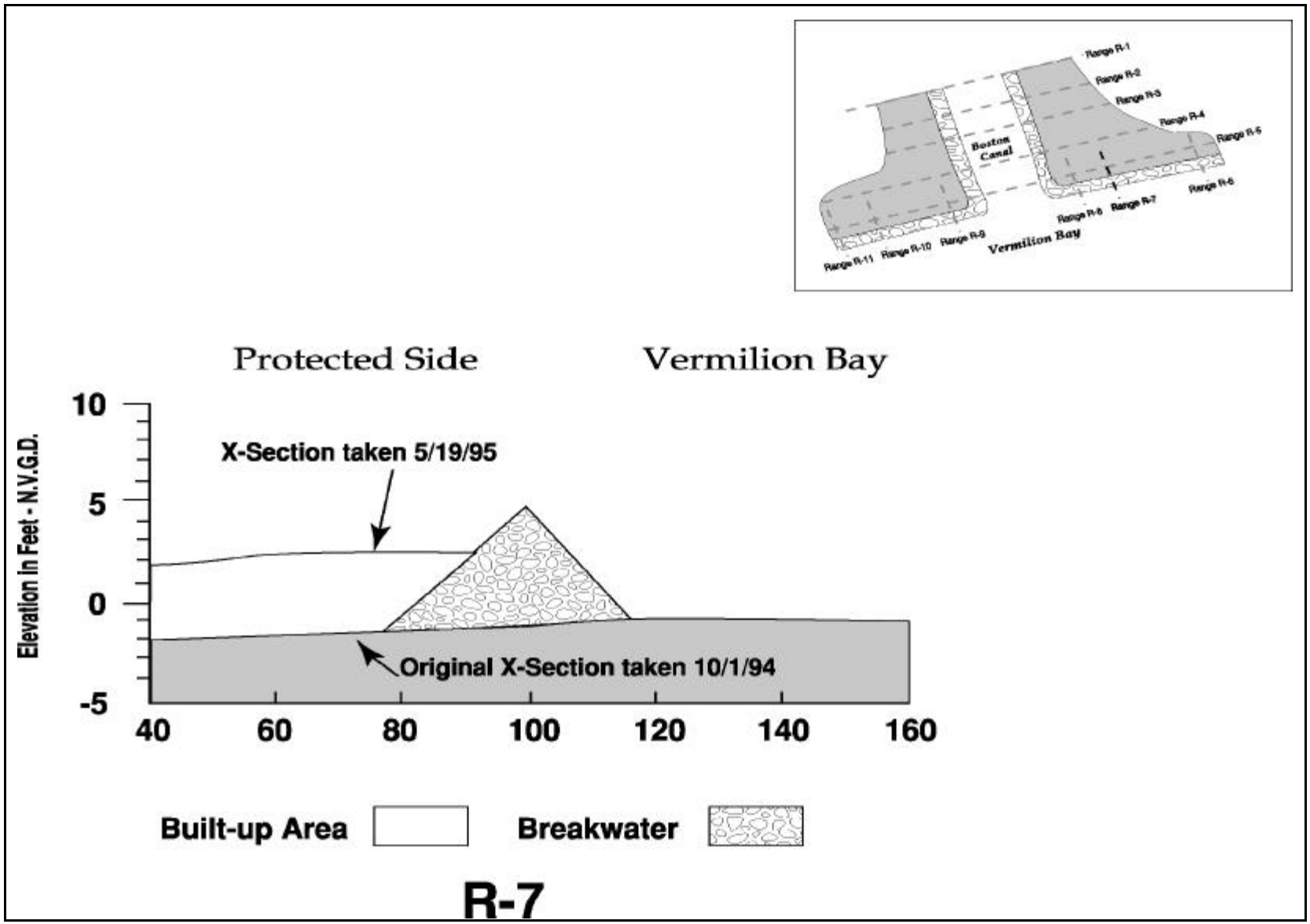

Figure 5. Boston Canal/Vermilion Bay Shoreline Protection (T/V-09) elevational profile of north-south transect R-7 showing accretion.

Vegetative Plantings: Installation of *S. alterniflora* plantings was initiated June 26, 1995, and completed September 28, 1995. The 6 and 12 mo postplanting monitoring of the 64 sampling plots was conducted on December 6, 1995, and June 6, 1996, respectively. Average percent survival in each land type ranged from 75.47 to 100% at 6 mo and from 74.55 to 100% at 12 mo (figure 6).

Initially, low cover values of 28.43%, 26.89%, and 12.11% were recorded in land type 1, 3, and 4 (figure 7), where plantings were interspersed with existing, intermittent stands of *Phragmites australis* (roseau cane). In land type 1, a small percentage of the initial plantings were installed amid the stands of *P. australis.* At 6 mo, these plants within the *P. australis* were spindly or absent, and at 12 mo, those plants were dead or absent, presumably due to competition for light and nutrients. In land types 3 and 4, the initial plantings were installed bayward of the stands of *P. australis* in approximately 1 ft (0.3 m) of water. At 6 mo, plants located in these land types indicated lower cover values and appeared water-logged and spindly. At 12 mo, the plants remained stressed from water-logged conditions. In land types 1, 3, and 4, survival decreased slightly from 6 months to 12 months (figure 6), although percent cover increased. Visual observations of the shoreline made on October 10, 1996 (16 mo post-planting) indicate that plantings range from 3–6 ft (0.9 - 1.8 m) high and are indistinguishable. The plantings in land type 3 that were installed bayward of *P. australis* were vigorously growing. Drought conditions in the spring and summer of 1996 resulted in water levels that were lower than normal in Vermilion Bay, probably allowing the plants to become established.

Summary statistics on the data from the vegetation surveys conducted at 6 and 12 mo postplanting indicated that survivorship (percent survival) decreased during the first 12 mo postplanting (table 1). However, the mortality rate decreased over the same period, from 0.07 between 0 and 6 months, to 0.02 between 6 and 12 mo, suggesting that the surviving plantings were becoming established by 12 mo postplanting.

An analysis of variance (ANOVA) was performed on vegetative planting survival and coverage to detect the differences in *S. alterniflora* mortality among the land types and to detect differences due to plant competition among three *P. australis* coverages within land type. No significant difference in mortality was found in either case indicating that the *S. alterniflora* plantings survived equally well at each land type.

The high survival rates of *S. alterniflora* plantings recorded after one year indicate that this is an ideal species for establishment in this environment. Their effectiveness in minimizing shoreline erosion will be determined after all subsequent shoreline surveys are conducted.

Habitat mapping: The TV-09 project area boundary was received in 1994 via FTP from the NWRC Coastal Restoration Office in Baton Rouge, LA. Just prior to the flight date, the NWRC was asked to obtain aerial photography of the reference area as well. Due to time constraints, the reference area boundary was digitized at the NWRC in Lafayette, LA from a 1:24,000 scale USGS topographic map.

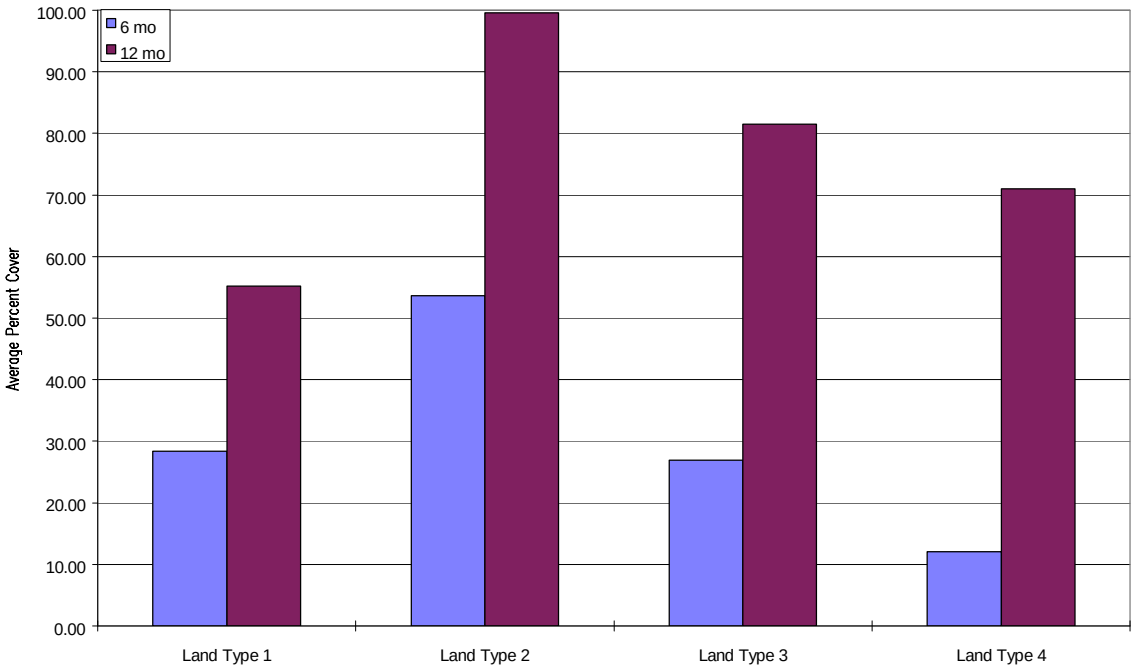

Figure 6. Average percent survival (# live/# planted x 100) of *Spartina alterniflora* plantings in land types 1–4 observed at 6 and 12 months postplanting 1995 and 1996.

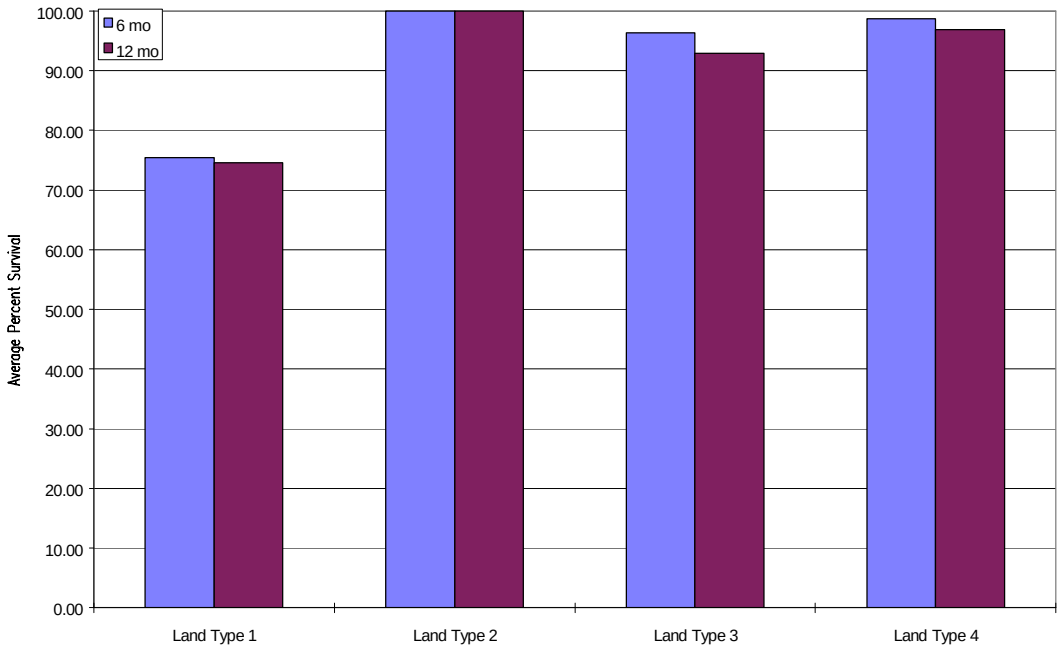

Figure 7. Average percent cover of *Spartina alterniflora* plantings land types 1–4 observed at 6 and 12 months.

Table 1. Partial life table of smooth cordgrass (*Spartina alterniflora*) plantings in the Boston Canal Vegetative Planting project area, based on means of data collected from sixty-four 16-plant sampling plots, from December 1995 to June 1996, at 6 and 12 mo postplanting.

Age (mo)	Survival Frequency (n)	Survivorship	Mortality	Mortality Rate
0	16	1	0.07	0.07
6	14.82	0.93	0.02	0.02
12	14.57	0.91		

n = mean # plants living per plot

Reference

Harper, J. L. 1977. *Population Biology of Plants*. New York: Academic Press.

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Construction Start:	July 1, 1994	
Construction End:	October 4, 1995	